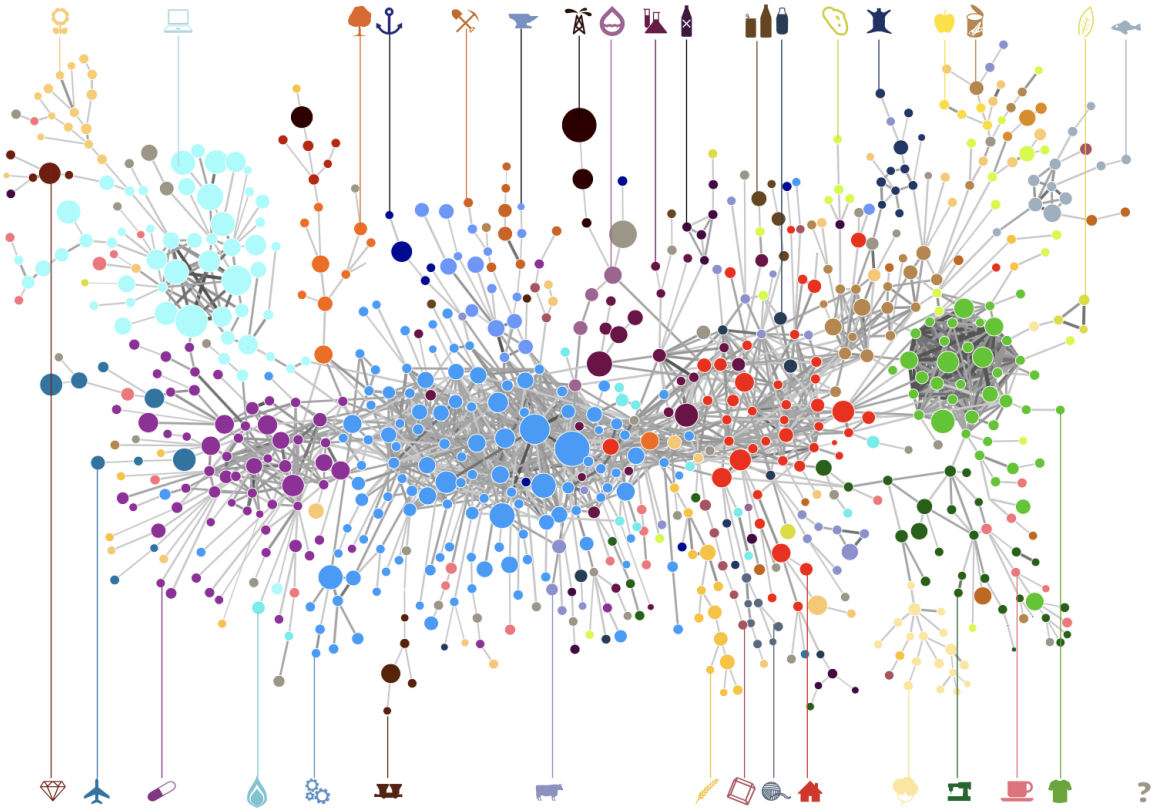

https://atlas.cid.harvard.edu/

Optimal Industry Development Strategy Using Economic and Product Complexity

India

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The Economic Complexity Lab - Columbia University

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Optimal Industry Development Strategy for India

0. Executive Summary

In this report, we aim to uncover the economic path India went through during the period from 2013 to 2022. Specifically, we dive into the topic through a macroeconomic overview of India from the perspective of Gross Domestic Product (GDP) and Economic Complexity Index (ECI), which reflect countries' production capability and production structure, respectively. We find that during the period of our interest, India demonstrated a high level of economic growth with an average annual GDP growth rate of 7.75% between 2013 and 2018 and 4.90% between 2019 and 2022, with a similar economic complexity compared to other major emerging economies.

The mixed progress during the period, we believe, can be partially explained through the analysis of the economic and product complexity structure of India on the industry group level, as well as the macro and microeconomic strategies. The product classification system we adopt allows us to measure the realized industry development for various industry groups and to observe that India regressed in developing most of its industries during the period while its emerging counterparts and economies around the globe also adopted complex and progressive paths with variable degrees of success.

Based on our analysis of the opportunity gain and sensitivity analysis of major industry groups, India could have furthered its gains by prioritizing Weapons, Raw Manufacturing, and High-complexity Products in 2018. Three years later, in 2022, its focus should have shifted to the Weapons and Machinery and Construction industries, which are also one of the more developed industries at the time. We further note that India has a mismatched development strategy that indicates a low level (compared to other emerging countries) of structural optimality on the complexity level, having an adjusted R-square of around 0.126 in 2018 and a lower score of 0.090 in 2022, demonstrating degradation in development. Since a significant positive correlation exists between GDP growth and the structural optimality index of an economy as we define and calculate, India indeed has a suboptimal growth experience as compared with fast-growing economies both on a regional scale and on a global scale and has the potential to further its economic gains through industrial structure optimization as suggested in the paper.

The years between 2019 and 2022 showed a significant improvement in India's economic growth, boosting its position on the global scale. Its GDP recovered to above the pre-pandemic levels, and it saw a boost in the ECI, particularly compared to its peer countries. Its current strategy still has the viable potential upside to increase its performance and optimize its structure further.

1. Report Overview

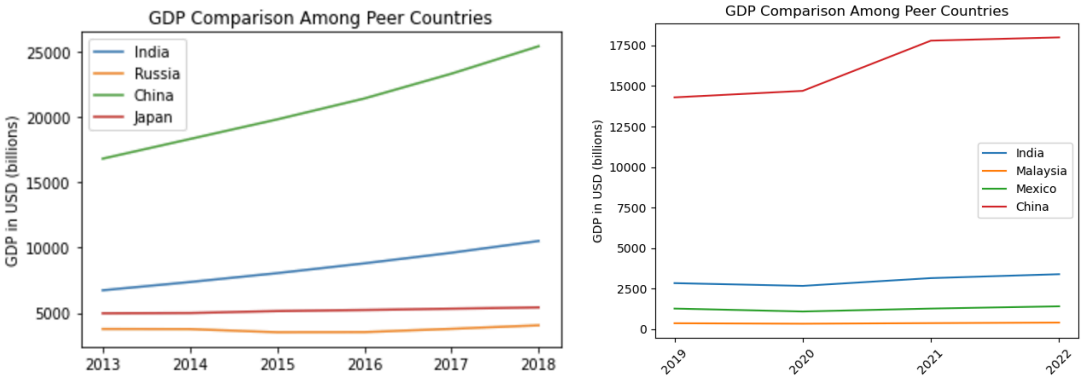
In this report, we aim to uncover the economic path India went through during the period from 2019 to 2022, before and after the COVID pandemic, compared to its performance from 2013 to 2018, before and after the launch of the "Make in India" campaign. Specifically, we dive into the topic through a macroeconomic overview of India from the perspective of Gross Domestic Product (GDP) and Economic Complexity Index (ECI), which reflect countries' production capability and production structure, respectively. We then analyze the industrial framework and changes of India during the period based on quantitative measures such as the Product Complexity Index (PCI) and Product Family Complexity Index (PfCI), followed by a detailed analysis of how such changes have matched with development strategies as quantitatively measured by opportunity gains on an industry-level. We conclude our report with macro-level results and predictions of India, as deduced from regression models we have established on a global scale, which take into account countries' stances in their product space.

2. Macroeconomic Results

2.1 GDP Ranking and Changes

Figure 1a illustrates the time-series GDP results for India and three of its peer countries (Russia, China, and Japan) from 2013 to 2018. Similar to the other countries, India displayed an eventual upward trend over the period; however, its growth was less consistent than China's growth. This is confirmed by India's average annual growth rate of 7.75% over the five-year period, which is higher than that of Russia (1.31%) and Japan (1.46%), and similar to China's (7.18%).

Figure 1b shows the GDP levels for India and its peer countries (Malaysia, Mexico, and China) from 2019 to 2022. Similar to the other countries, India displayed a drop in GDP from 2019 to 2020 because of the pandemic, with all GDPs rebounding in 2022. Over these three years, India's average annual GDP growth rate (4.90%) is moderate, as it is greater than Malaysia's (2.96%) and Mexico's (3.34%), but less than China's (6.25%).



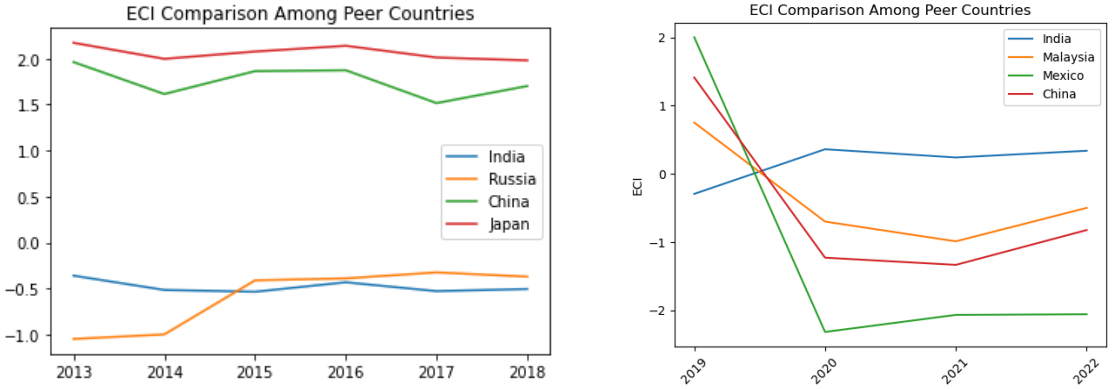
Figures 1a and 1b. GDP Comparison Among Peer Countries (left: 2013-2018; right: 2019-2022)

2.2 ECI Ranking and Changes

The Economic Complexity Index (ECI), as defined by Ricardo Hausmann and Cesar Hidalgo in 2009 to explain the knowledge accumulated in a country's population, is illustrated in Figures 2a and 2b.

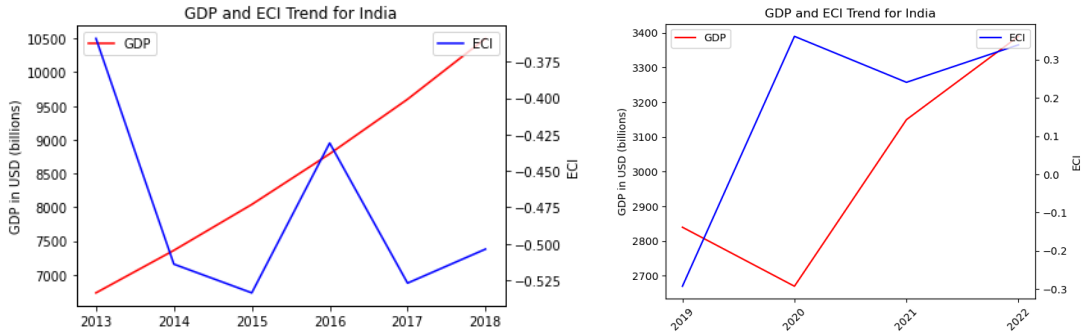
As shown, India exhibits a decrease in production capability from 2013 to 2018. India is in a weak position in ECI terms, as its ECI change of -40.35% is lower than that of Russia (64.66%), China (-13.27%), and Japan (-8.79%).

The comparable countries decrease in ECI level between 2019 and 2020, with slight increases between 2020 and 2022. India exhibits an increase between 2019 and 2020, with growth in the technology sector being one of the reasons. India has seen a 215.84% increase in its ECI, which is greater than Malaysia's (-166.2%), China's (-158.24%), and Mexico's (-202.7%).



Figures 2a and 2b. ECI Comparison Among Peer Countries (left: 2013-2018; right: 2019-2022)

Figures 3a and 3b offer a further comparison of GDP Growth and ECI over the time span from 2013 to 2022 for India. Similar to the GDP drop and further increase from 2013 to 2018, the GDP growth during the period from 2019 to 2022 is accompanied by a similarly volatile increase in ECI. The results show that the economic growth experienced by India during the period from 2013 to 2018 is only slightly correlated with the predictions by ECI and that India made weak progress towards effectively developing a competitive product space that helps to accumulate complicated knowledge and technology. For the period 2019 to 2022, the ECI followed GDP trends, which can be interpreted as advancements in production. In order to provide a more concrete answer to why this has happened, we will dive into an analysis of India's production structure and its product space designs in the next few sections.



Figures 3a and 3b. GDP Growth and ECI for India (left: 2013-2018; right: 2019-2022)

3. Production Analysis

3.1 Product Categorization

Our main data source in this research is the UN Comtrade Website (https://comtrade.un.org), which provides us with valuable information on countries' export values on an annual basis, including highly specific export data for more than 5000 categories of products. In order to have a holistic vision of the product space of a country, however, a level of categorization is required. Products in our data source are labeled from 010000-999999, with the first two digits representing a general category to which the product belongs. Based on the 99 categories extracted from the label, we further group the products into the 18 most widely-accepted industries, as summarized in Table 1.

Note that the High-complexity Products industry group is not a distinct industry but rather an aggregated industry that encompasses the most complicated products from the most technologically-advanced industries (as measured by PCI). This industry serves as an indicator for us to quantitatively evaluate how well a country has performed in developing cutting-edge technologies and closing its technological gap with advanced economies, which has become a topic of wide concern today. Indeed, when we rank the 18 categories based on PfCI (an equivalent concept of PCI as calculated based on the 18 categorized product groups), the High-complexity Products industry has the highest PfCI among all industry groups.

Category	Description
Animals and By-products	All kinds of meat, livestock and related by-products
Vegetables, Fruits and Plants	All kinds of plants, edible vegetables and fruits
Food and Preparations	Edible preparations, raw cooking materials and appliances
Clothing and Accessories	All kinds of fabrics, filament, clothing and accessories
Textiles	All kinds of textile articles and related products
Wood Products	Book, paper and other elementary products related to wood
Metals	Mining of all sorts of raw Metals
Refined and Processed Stones	Refined or processed stone products such as pearl and ceramics
Energy Drilling and Mining	Mining industry for energy, minerals, stone materials, etc.
Daily Instruments	Basic daily instruments such as sport requisites, timing and measuring tools
Raw Manufacturing	Basic products made from plastic, rubber, leather, etc.
Chemical Manufacturing	Advanced chemical products and pharmaceutical products
Chemicals	Raw chemical materials and by-products
Machinery and Construction	Machinery and mechanical appliances, including electrical equipment
Transportation	Vehicles and locomotives including aircraft, ship, railway, etc.
Weapons	Explosives, arms and ammunition
Services and Utilities	Financial, business, legal, communication, travel Services and Utilities, etc.
High-complexity Products	Agglomeration of advanced products with highest PCIs

Table 1. Categorization of Products

We further observe a positive correlation between the GDP and the export of High-complexity Products. A higher adjusted R-square exists between GDP and High-complexity Products exports, indicating that more successful economics, as measured by GDP, tend to be those that are capable of producing and exporting High-complexity Products as we define them. Tables 2a and 2b show the OLS results in a universe of 107 and 21 typical countries respectively.

	High-complexity Products	Food and Preparations	Animals and By-products
Adj. R-squared	0.075	0.006	0.002
F-statistic	9.556	1.638	1.175
No. Observations	107	107	107

Table 2a. OLS Regression Results of GDP against Percentage Volume of Exports

	High-complexity Products	Food and Preparations	Animals and By-products
Adj. R-squared	0.149	0.003	-0.012
F-statistic	4.510	1.059	0.7542
No. Observations	21	21	21

Table 2b. OLS Regression Results of GDP against Volume of Percentage Exports

3.2 Realized Industry Development

Based on the aforementioned product categorization, we aim to capture India's realized industry production strategy between 2013 and 2022 on a complexity level. In Hausmann and Hidalgo (2009), distance is defined to be a measure of how far a country is from a certain product, not in its product space. We extend this concept to all product groups and quantify how technically equipped a country is to develop the corresponding product groups. In other words, the shorter the distance between a country and a product group, the more capable a country is of developing products within that group. Defining this net distance change as the Realized Industry Development (RID), our export data allow us to calculate and compare the RID of India and the 18 product groups in 2022 and 2018 through the difference, where a positive RID indicates a shortening of the distance (i.e., advancement of the industry), and a negative RID indicates the reverse. It is notable that the number of industries with positive RID has decreased from 2018 to 2022.

Category	RID (2022)	RID (2018)
Daily Instruments	0.000850	0.020327
Chemicals	-0.046311	-0.002772
Weapons	-0.017180	-0.005812
Wood Products	0.030216	0.006997
Transportation	-0.012925	0.053971
Machinery and Construction	-0.005397	-0.013036
Metals	-0.002336	-0.013561
Raw Manufacturing	-0.012870	-0.011949
Services and Utilities	-0.003868	-0.020676
Clothing and Accessories	-0.014967	-0.032151
Chemical Manufacturing	-0.022936	-0.009016
Food and Preparations	-0.004701	-0.015875
Textile	-0.008554	-0.035327
High-complexity Products	-0.012672	0.029753
Vegetables, Fruits and Plants	-0.010873	-0.013117
Animals and By-products	-0.008646	-0.021231
Energy Drilling and Mining	0.013287	-0.001932
Precious Stones	-0.019597	-0.006538

Table 3. Realized Industry Development (RID) of India

3.3 Regional and Global Comparison

Tables 4a-4b below summarize how the production strategy adopted by India compares with selected leading economies in the world across different years, as measured in RID. Leading economies such as Germany, France, and Canada gave a considerable level of attention to more advanced product groups such as High-complexity Products in 2018 and Transportation in 2022.

Ranking	France	the UK	Germany
1	High-complexity Products	Services and Utilities	High-complexity Products
2	Chemical Manufacturing	Weapons	Transportation
3	Daily Instruments	Raw Manufacturing	Wood Products
4	Animals and By-products	Precious Stones	Metals
5	Food and Preparations	Animals and By-products	Food and Preparations

Table 4a: RID Comparison across Leading Economies (2018)

Ranking	Canada	Germany
1	Energy Drilling and Mining	Daily Instruments
2	Animals and By-products	Chemicals
3	Vegetables, Fruits and Plants	Transportation
4	High-complexity Products	Chemical Manufacturing
5	Wood Products	Metals

Table 4b: RID Comparison across Leading Economies (2022)

Tables 4c-4d further examine India's development strategy against those of emerging economies on a global scale. Reasonably, emerging economies such as China, South Korea, and Singapore have devoted the majority of their efforts to intermediate industry groups, showing moderate shifts in strategies over the course of four years.

Ranking	China	South Korea	Singapore
1	High-complexity Products	Transportation	Transportation
2	Transportation	Textile	High-complexity Products
3	Machinery and Construction	High-complexity Products	Precious Stones
4	Energy Drilling and Mining	Chemical Manufacturing	Daily Instruments
5	Daily Instruments	Machinery and Construction	Services and Utilities

Table 4c: RID Comparison across Emerging Economies (2018)

Ranking	China	South Korea	Singapore
1	Daily Instruments	Chemicals	Transportation
2	Chemicals	Daily Instruments	Weapons
3	Raw Manufacturing	Metals	High-complexity Products
4	Metals	Raw Manufacturing	Energy Drilling and Mining
5	Machinery and Construction	Machinery and Construction	Machinery and Construction

Table 4d: RID Comparison across Emerging Economies (2022)

4. Product Space Design

4.1 Suggested Development Vector

As outlined above, distance gives us an idea of how far each new product is from a country's current mix of exports. As defined in Hausmann and Hidalgo (2009), distance is "the weighted proportion of products connected to goods p that country c is not exporting, i.e., MCP = 0." Based on this definition, the distance between a country and any product that the country is currently exporting (i.e., the country is a significant exporter of the product as compared to the global average) is zero. Similarly, opportunity gain quantifies the contribution of a new product in terms of opening up the doors to more and more complex products. Intuitively, a product that a country is currently exporting (i.e., MCP = 1) has an opportunity gain of zero. An unreasonable investment in a certain product p would lead to a relative decrement in the export of more profitable products and therefore lead to a negative opportunity gain of product p. The opportunity gain is not the only estimator of a country's level of economic development. However, among countries with comparable economic strength, those having higher ECI, or in other words, more reasonable economic structures are often in better shape.

Ranking	Spain	India	Greece
1	Energy Drilling and Mining	Weapons	Precious Stones
2	Precious Stones	Raw Manufacturing	Weapons
3	Weapons	Machinery and Construction	Clothing and Accessories
4	Textile	Services and Utilities	Machinery and Construction
5	Chemicals	Daily Instruments	Services and Utilities
6	Daily Instruments	High-complexity Products	High-complexity Products
7	Animals and By-products	Transportation	Daily Instruments
8	Vegetables, Fruits and Plants	Animals and By-products	Transportation
9	Food and Preparations	Vegetables, Fruits and Plants	Chemicals
10	Chemical Manufacturing	Food and Preparations	Animals and By-products
11	Raw Manufacturing	Energy Drilling and Mining	Vegetables, Fruits and Plants
12	Wood Products	Chemicals	Food and Preparations
13	Clothing and Accessories	Chemical Manufacturing	Energy Drilling and Mining
14	Metals	Wood Products	Chemical Manufacturing
15	Transportation	Clothing and Accessories	Raw Manufacturing
16	Services and Utilities	Textile	Wood Products
17	Machinery and Construction	Metals	Textile
18	High-complexity Products	Precious Stones	Metals
ECI	0.45830144	-0.358933609	-0.232930358

Table 5a. Opportunity Gain Ranking on a Comparable Scale (2013)

Ranking	Spain	India	Greece
1	Energy Drilling and Mining	Weapons	Precious Stones
2	Precious Stones	Raw Manufacturing	Clothing and Accessories
3	Weapons	High-complexity Products	High-complexity Products
4	Textile	Transportation	Transportation
5	Services and Utilities	Machinery and Construction	Machinery and Construction
6	Chemicals	Services and Utilities	Weapons
7	Daily Instruments	Daily Instruments	Chemicals
8	Machinery and Construction	Animals and By-products	Services and Utilities
9	Animals and By-products	Vegetables, Fruits and Plants	Daily Instruments
10	Vegetables, Fruits and Plants	Food and Preparations	Animals and By-products
11	Food and Preparations	Energy Drilling and Mining	Vegetables, Fruits and Plants
12	Chemical Manufacturing	Chemicals	Food and Preparations
13	Raw Manufacturing	Chemical Manufacturing	Energy Drilling and Mining
14	Wood Products	Wood Products	Chemical Manufacturing
15	Clothing and Accessories	Clothing and Accessories	Raw Manufacturing
16	Metals	Textile	Wood Products
17	Transportation	Metals	Textile
18	High-complexity Products	Precious Stones	Metals
ECI	0.168962035	-0.503771207	-0.425579783

Table 5b. Opportunity Gain Ranking on a Comparable Scale (2018)

Rank	India	Malaysia	Togo
1	Weapons	Services and Utilities	Weapons
2	Machinery and Construction	Chemical Manufacturing	Vegetables, Fruits and Plants
3	Food and Preparations	High-complexity Products	Machinery and Construction
4	Raw Manufacturing	Precious Stones	Wood Products
5	Wood Products	Chemicals	Services and Utilities
6	Services and Utilities	Vegetables, Fruits and Plants	Precious Stones
7	Daily Instruments	Animals and By-products	Chemicals
8	Transportation	Machinery and Construction	Daily Instruments
9	High-complexity Products	Wood Products	Metals
10	Animals and By-products	Textile	Transportation
11	Vegetables, Fruits and Plants	Food and Preparations	High-complexity Products
12	Energy Drilling and Mining	Energy Drilling and Mining	Animals and By-products
13	Chemicals	Raw Manufacturing	Food and Preparations
14	Chemical Manufacturing	Metals	Energy Drilling and Mining
15	Clothing and Accessories	Transportation	Chemical Manufacturing
16	Textile	Weapons	Raw Manufacturing
17	Metals	Daily Instruments	Clothing and Accessories
18	Precious Stones	Clothing and Accessories	Textile
ECI	0.338973	-0.498173	0.315147

Table 5c. Opportunity Gain Ranking on a Comparable Scale (2022)

We define the ranking of opportunity gain for a country c, as the Suggested Development Vector (SDV) of c. Tables 5a-5c summarize how the SDV of India compares with a selected group of comparable and leading economies in the world, with the industry groups ranked in decreasing order of significance.

Dark blue indicates positive opportunity gains, light blue indicates zero opportunity gains, and white indicates negative opportunity gains. The result shows that leading countries barely have any industries with positive opportunity gain. In other words, those countries are already in the most stable and efficient economic structure. Without the necessity of economic transition, those countries merely need to maintain a steady and balanced economic development. In contrast, developing countries have nearly half of industries with positive opportunity gain and share common interests in Machinery and Construction. It can be concluded that India shares the characteristics of developing countries, with a balanced economic structure.

Ranking	Thailand	Italy	Spain	United Arab Emirates
1	Animals and By-products	Energy Drilling and Mining	Energy Drilling and Mining	High-complexity Products
2	Food and Preparations	Precious Stones	Precious Stones	Transportation
3	Chemicals	Vegetables, Fruits and Plants	Weapons	Machinery and Construction
4	Raw Manufacturing	Animals and By-products	Textile	Daily Instruments
5	Textile	Food and Preparations	Chemicals	Chemicals
6	Machinery and Construction	Chemical Manufacturing	Daily Instruments	Weapons
7	Transportation	Raw Manufacturing	Animals and By-products	Textile
8	High-complexity Products	Wood Products	Vegetables, Fruits and Plants	Chemical Manufacturing
9	Energy Drilling and Mining	Clothing and Accessories	Food and Preparations	Raw Manufacturing
10	Vegetables, Fruits and Plants	Textile	Chemical Manufacturing	Energy Drilling and Mining
11	Precious Stones	Metals	Raw Manufacturing	Precious Stones
12	Weapons	Machinery and Construction	Wood Products	Services and Utilities
13	Clothing and Accessories	Daily Instruments	Clothing and Accessories	Metals
14	Services and Utilities	High-complexity Products	Metals	Clothing and Accessories
15	Wood Products	Weapons	Transportation	Wood Products
16	Metals	Chemicals	Services and Utilities	Animals and By-products
17	Chemical Manufacturing	Services and Utilities	Machinery and Construction	Vegetables, Fruits and Plants
18	Daily Instruments	Transportation	High-complexity Products	Food and Preparations
ECI	1.68914409	1.179705915	0.45830144	-0.734459148

Table 6. SDV of Other Sample Countries (2019)

4.2 Budgeted Industry Development Strategy and Interpretation

The optimal budgeted industry development strategy aims to solve the most efficient allocations under the budgeted constraint of different situations of heuristic total export growth. In order to obtain such an allocation portfolio, we formulate an optimization problem as the following:

$$\max_{x \in \mathbf{R}^{|P|}} \quad \left(\frac{k(x) - < k(x) >}{stdev(k(x))}\right)_C$$

$$\text{Subject to}$$

$$\sum_{p \in P} x_p \leq B$$

$$x \succcurlyeq 0$$

where k(x) is the second largest eigenvector of $M_{CC'}$ after adding x to the original export vector, C is the country that we are interested in, P is the product space, B is the heuristic budget.

If we can solve this problem, then we can know what the largest ECI to which a country can improve. Accordingly, the optimal solution x * that we obtain here is exactly our optimal allocation. However, the biggest problem is that the objective function is not convex. Therefore, we cannot apply the classical tools for convex optimization to this problem. In order to solve this problem, our idea is to use a greedy algorithm. The way that we apply the greedy algorithm is that firstly we separate the total budget into k equal parts, and then for the first equal part we try to search for the product that can optimize our objective function by iterating through each $p \in P$. After we find the optimal product p for this equal part, we add the amount back to the export value of this product p and update the ECI for this country. If we observe that ECI does not change after iterating all the products, then we can add up one more equal part to invest. Until we find there is an ECI increment, we add the amount now to that product. The equal rest parts can be done in the same way.

By definition, a greedy algorithm is a kind of local search algorithm that is possible to run into a local minimum. Therefore, for local search algorithms, one typical way to keep it away from the local minimum is to enhance the vision of the algorithm by looking more steps forward. In our setting, whenever we obtain an increment of ECI, we mark down the required amount of export growth. Simultaneously, we continue searching for the next ECI increment point, compare the ratios of these two possibilities and pick the largest one. The ratio is defined as the following:

$$Ratio(p) = \frac{ECI_p - ECI_0}{||x_p - x_0||_1}$$

where ECI_p is just the ECI of the country after adding some amount of export increment to product p, which is exactly the amount that is able to make ECI change. Also, we can express it in the way of $||x_p - x_0||_1$.

In this way, we can obtain a further sighted greedy algorithm. Also, the number of parts that we would like to separate the budget into also matters. In order to solve this problem, we added a stabilizer on top of the enhanced greedy algorithm by running the algorithm for different numbers of parts and selecting the portfolio with the largest ECI increment and most complex economic structure.

Besides, it is quite common that there is a surplus in the budget. To deal with the surplus, we just add it to the product which needs the least amount of dollars to make M_{cp} = 1 (i.e., the smallest amount of required export increase).

Economic Panel

As stated above, the enhanced greedy algorithm is developed mainly for solving the optimal allocation strategy. In order to visualize this allocation, an economic panel is created, consisting of a pie chart, a line chart and a table. First, a pie chart is used to show the percentage of each product in the optimal portfolio. The number located in the center of the circle denotes the heuristic growth of total export, which is also our budget. Each category in the chart has a determined percentage of the allocated budget. The lines below the pie charts show how the ECI changes during the searching process of the greedy algorithm. Even

though sometimes an increase of the export by 15% or 20% does not seem reasonable to developed countries, yet it can also give a sense of how a country should develop in the long term. Eventually, the graph in the end is just for numerical explanation for the pie charts.

Interpretation

For the purpose of a clear explanation of the line charts, we label all the products in Table 7. Please refer to this table when trying to understand the investment trajectories in the line charts.

Label	Product Names
1	Animal and By-products
2	Vegetables, Fruits and Plants
3	Food and Preparations
4	Energy Drilling and Mining
5	Chemicals
6	Chemical Manufacturing
7	Raw Manufacturing
8	Wood Products
9	Clothing and Accessories
10	Textile
11	Metals
12	Machinery and Construction
13	Transportation
14	Weapons
15	Daily Instruments
16	Precious Stones
17	High-complexity Products
18	Services and Utilities

Table 7. Products Labeling

Figures 4a-4c show an economic panel for India in 2013, 2018, and 2022. We can see that for different percentages of heuristic total export growth, the ECIs of India actually have different increments.

For 2013, in the case of 5 percent export growth, Raw Manufacturing is one of the main components. With a budget of 10 percent export growth, Weapons and Daily Instruments account for most of the portfolio. As the budget increases to 15 percent, the portfolio becomes significantly more diverse, with key industries including machinery and construction, daily instruments, and raw manufacturing. When the budget rises to 20 percent, the portfolio becomes even more comprehensive, with metals added as a critical industry for development. In addition to the previously mentioned sectors, products such as chemical manufacturing and high-complexity goods are also considered. Among the four ECI improvement trajectories, the most significant gains are observed in raw manufacturing, services, and utilities. This suggests that, with lower expectations for economic improvement, India should focus more on developing these sectors. A more detailed numerical representation of the portfolio is shown in Table 8a.

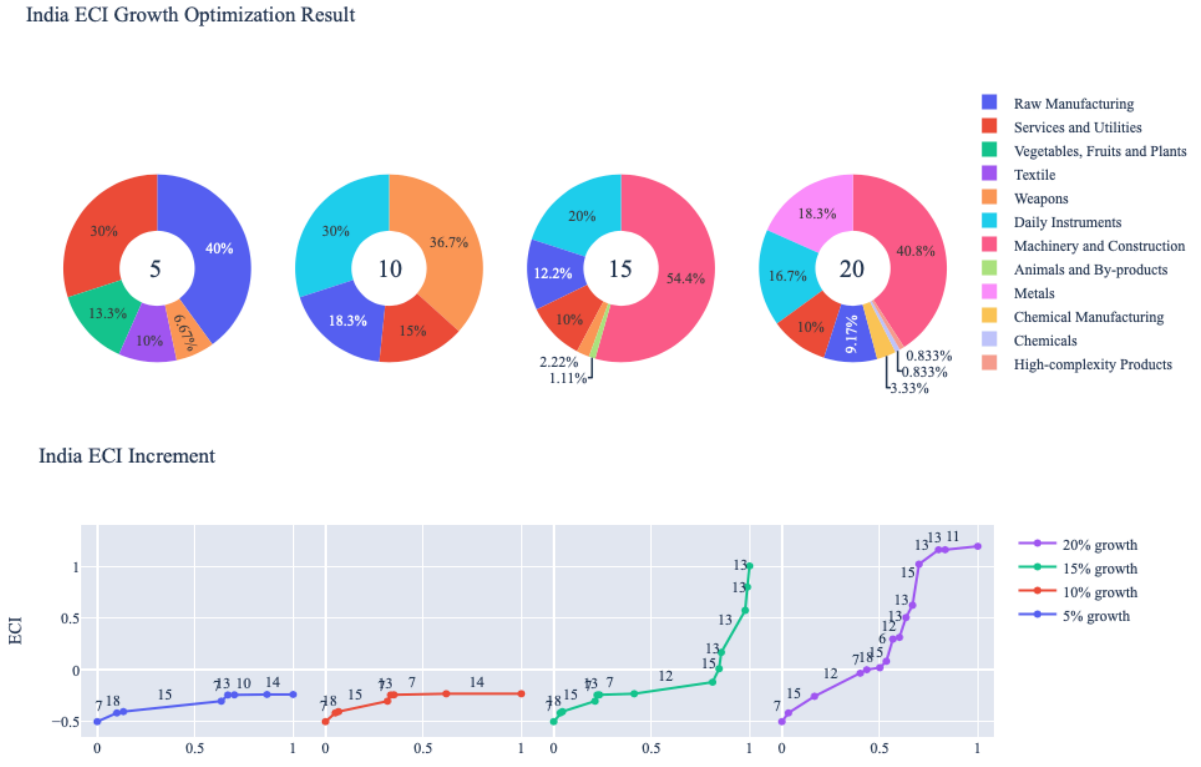


Figure 4a. Greedy-Based ECI Improvement Results of India with Different Budgets (2013)

	India (2013)			
Original ECI		-0.36		
Heuristic Export Growth	5%	10%	15%	20%
Animals and By-products	0.00E+00	0.00E+00	6.88E+08	0.00E+00
Vegetables, Fruits and Plants	2.75E+09	0.00E+00	0.00E+00	0.00E+00
Chemicals	0.00E+00	0.00E+00	0.00E+00	7.34E+08
Chemical Manufacturing	0.00E+00	0.00E+00	0.00E+00	2.94E+09
Raw Manufacturing	8.26E+09	9.71E+09	7.57E+09	8.07E+09
Textile	2.06E+09	0.00E+00	0.00E+00	0.00E+00
Metals	0.00E+00	0.00E+00	0.00E+00	1.61E+10
Machinery and Construction	0.00E+00	0.00E+00	3.37E+10	3.60E+10
Weapons	1.38E+09	1.94E+10	1.38E+09	0.00E+00
Daily Instruments	0.00E+00	1.59E+10	1.24E+10	1.47E+10
High-complexity Products	0.00E+00	0.00E+00	0.00E+00	7.34E+08
Services and Utilities	6.19E+09	7.95E+09	6.19E+09	8.81E+09
Increased ECI	-0.09	0.03	0.23	0.91

Table 8a. Portfolio of India (2013)

For further suggestions on India's development in the future, we also offer the optimization result based on its export data in 2018. Below is the economic panel for India in 2018. For the cases of 5% and 10% export growth, while the ECI improvement trajectories are relatively similar, the main components of the portfolio are quite distinct. At 5% growth, daily instruments and textiles dominate the portfolio, whereas at 10% growth, weapons and raw manufacturing take precedence. As the export growth budget increases to 15% or 20%, India's ECI improves significantly, rising from -0.50 to 1.00 or even 1.20. With a 15% export growth budget, the portfolio is primarily composed of machinery and construction, raw manufacturing, and daily instruments. However, when the budget increases to 20%, the portfolio becomes more balanced, with machinery and construction, daily instruments, transportation, and metals emerging as the key components, each holding a similar weight. A more detailed numerical representation of the portfolio is shown in Table 8b.

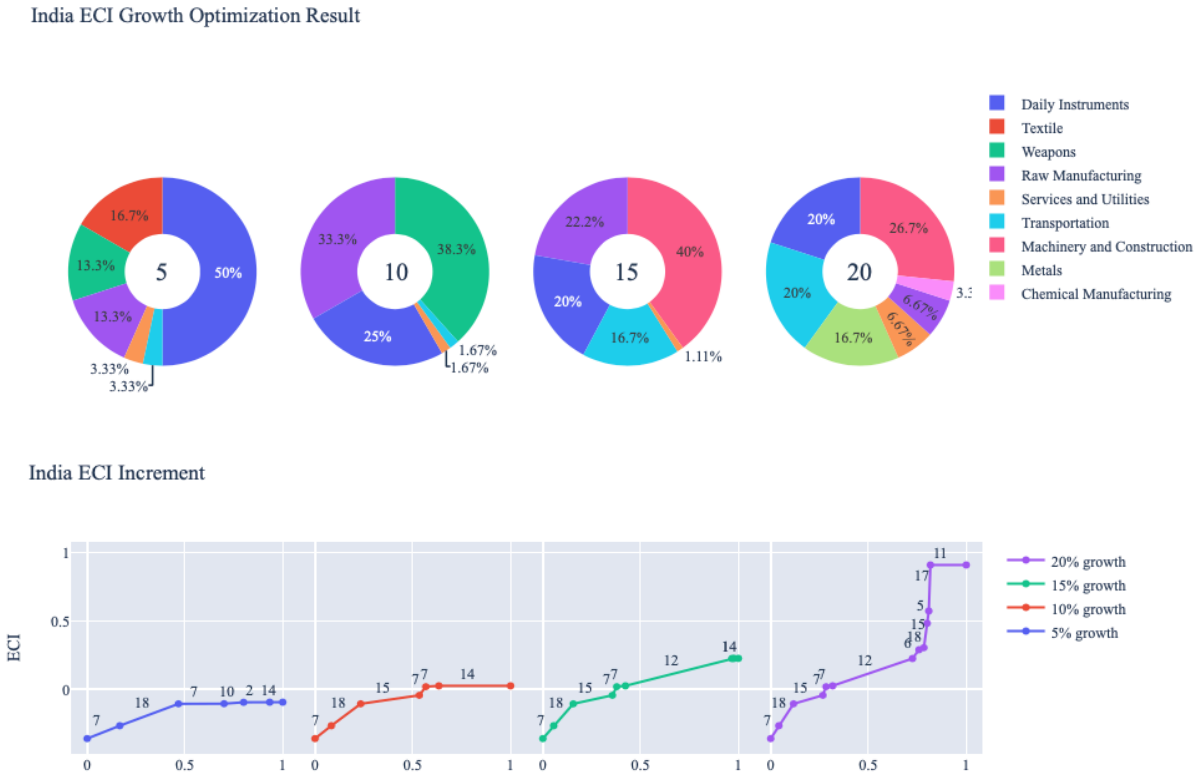


Figure 4b. Greedy-Based ECI Improvement Results of India with Different Budgets (2018)

	India (2018)			
Original ECI		-0.50		
Heuristic Export Growth	5%	10%	15%	20%
Chemical Manufacturing	0.00E+00	0.00E+00	0.00E+00	8.17E+09
Raw Manufacturing	2.79E+09	1.39E+10	5.65E+10	1.63E+10
Textile	3.48E+09	0.00E+00	0.00E+00	0.00E+00
Metals	0.00E+00	0.00E+00	0.00E+00	4.09E+10
Machinery and Construction	0.00E+00	0.00E+00	1.02E+11	6.54E+10
Transportation	6.97E+08	6.97E+08	4.24E+10	4.90E+10
Weapons	2.79E+09	1.60E+10	0.00E+00	0.00E+00
Daily Instruments	1.04E+10	1.04E+10	5.09E+10	4.90E+10
Services and Utilities	6.97E+08	6.97E+08	2.83E+09	1.63E+10
Increased ECI	-0.24	-0.23	1.01	1.20

Table 8b. Portfolio of India (2018)

To compare with the performance in 2013 and 2018, we also re-examine suggested strategies for 2022. For 2022, a 5 percent increase in export would emphasize Textiles, followed by Food and Preparations, and Chemicals for 10, 15, and 20 percent export growth respectively. These strategies go in line with the suggested trajectories based on ECI. As export growth increases to 15 and 20 percent, Chemicals emerge as a key focus, reflecting the need for higher complexity and technological advancement in the portfolio. The investment strategies follow this trajectory, with a progressive shift toward industries that contribute to economic complexity and growth. A more detailed numerical representation of the portfolio for India is shown in Table 8c.

Figure 4c. Greedy-Based ECI Improvement Results of India with Different Budgets (2022)

India (2022)				
Original ECI			**0.339**	
Heuristic Export Growth	**5%**	**10%**	**15%**	**20%**
Food and Preparations	3.52E+09	2.87E+10	7.23E+09	0.00E+00
Chemicals	0.00E+00	2.87E+10	6.51E+10	6.42E+10
Wood Products	0.00E+00	0.00E+00	0.00E+00	4.59E+09
Textile	2.25E+10	4.66E+10	3.25E+10	6.42E+10
Precious Stone	8.82E+08	0.00E+00	0.00E+00	0.00E+00
Increased ECI	**0.598**	**0.663**	**0.663**	**0.853**

Table 8c. Portfolio of India (2022)

4.3 Sensitivity Analysis and Contingency Strategy

In the following section, our broad aim is to understand how sensitive India is to changes in export in various industries. While the Economic Complexity Index has been shown to contain valuable information about the economic strength/capacity of a country, little has been said as to the stability of the measure itself. We seek to uncover the main drivers of stability under a country's ECI score and better understand longer-term projections for ECI growth. Additionally, gaining an intuition on the industries that are bolstering an economy and the industries that offer the greatest return per unit of investment is best done through visualization of industry-specific sensitivity. To this end, we have developed two categories of sensitivity analysis.

ECI Sensitivity Graph

First, in order to assess the effect particular industries have on each respective country, we developed ECI Sensitivity graphs (Figure 5). We use the shocking methodology to increment or decrement an industry's export level by a certain percentage and recalculate the ECI, all else being equal. While freezing the export dynamics of the rest of the world and enacting an instantaneous shock in export for a particular industry and country may not reflect real-life dynamics, what it does offer us is an understanding of a country's level of dependency on an industry in the context of ECI. The shocking is done in small percentage increments in order to smooth out the resulting curve. Additionally, a recurring theme one will see is that for most industries, a breaking point occurs where the ECI either jumps upwards or downwards, creating a hockey stick shape rather than a linear trend. While the inflection point may not be accurate in the context of real life, comparing the various inflection points across industries can give us valuable insight.

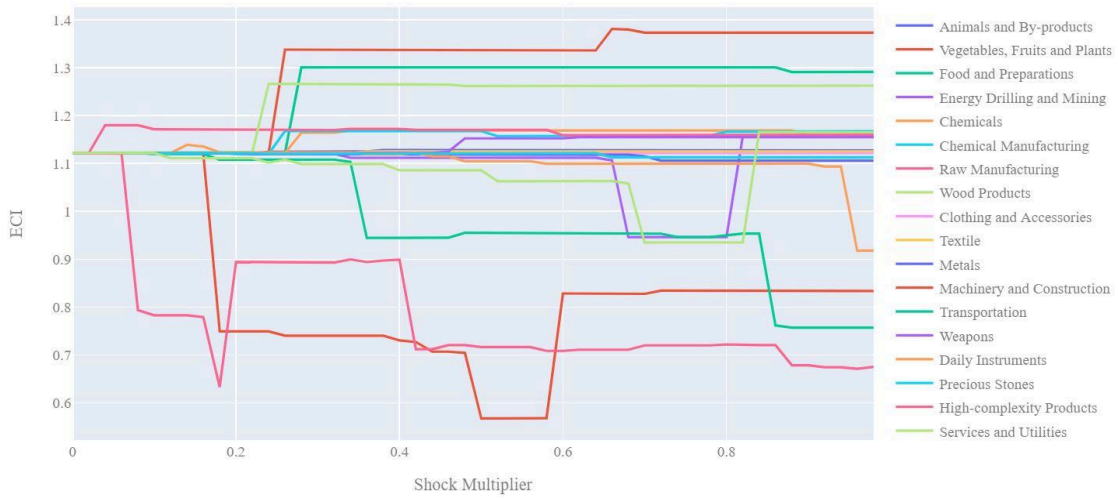


Figure 5. Sample ECI Sensitivity Graph (2018)

The graphs are formulated as follows. There are six ECI Sensitivity graphs, two for each of the following years: 2022, 2018, and 2013. The first chart, Incremental ECI Sensitivity, shows positive shocking in which export numbers are shocked upwards per industry. The X-axis is in terms of percentage shock per current dollar value of export. The Y-axis is the recalculated ECI level post-shocking. The second chart, Decremental ECI Sensitivity, follows the same format except the X-axis represents negative shock. In other words, exports for each industry are decremented, and the ECI is accordingly recomputed.

SDV Sensitivity

Secondly, we analyze the sensitivity of the SDV to changes in export levels. The goal is to understand how export level changes for a particular industry can affect the marginal opportunity gain for other industries. We will be using specifically High Complexity Products

and Food and Preparations as our base industries. We will be increasing or decreasing the absolute export level in both of these industries and observing the effects on the SDV.

When the opportunity gain of an industry is negative, the SDV sensitivity approximates how an over-development of the industry jeopardizes the economic structure of a country. When the opportunity gain of the industry is zero, the SDV sensitivity determines whether the further development of the industry shapes the country with a better economic structure and predicts how the SDV would change accordingly. Specifically, as we reduce the export of such an industry to 25%-50% of its original value, a few other industries originally with negative opportunity gain could likely become profitable.

Similar to the ECI sensitivity graphs above, we will be shocking export of High Complexity Products and Food and Preparations in small percentage increments. A new SDV, represented by a new column in the charts, is recorded only when a certain level of shock changes the structure of the SDV. In effect we are incrementing or decrementing export levels of two industries until the marginal opportunity gain of any industry changes in category (positive, negative, or neutral). Below is an example of a SDV Sensitivity chart with Positive Shocking. Industries with positive marginal opportunity gain are colored blue, neutral is colored white and negative is colored red.

	0.0%	10.0%	30.0%	50.0%	80.0%	100.0%	120.0%
0	Vegetables, Fruits and Plants	Vegetables, Fruits and Plants	Vegetables, Fruits and Plants	Chemicals	Chemicals	Chemicals	Machinery and Construction
1	Daily Instruments	Daily Instruments	Daily Instruments	Services and Utilities	Services and Utilities	Daily Instruments	Chemicals
2	Weapons	Weapons	Weapons	Textile	Textile	Textile	Daily Instruments
3	Transportation	Transportation	Transportation	Weapons	Daily Instruments	Services and Utilities	Services and Utilities
4	Machinery and Construction	Machinery and Construction	Machinery and Construction	Transportation	High-complexity Products	Transportation	Transportation
5	Metals	Metals	High-complexity Products	Machinery and Construction	Transportation	Chemical Manufacturing	Textile
6	High-complexity Products	High-complexity Products	Chemicals	High-complexity Products	Machinery and Construction	Weapons	Chemical Manufacturing
7	Chemicals	Services and Utilities	Services and Utilities	Daily Instruments	Chemical Manufacturing	High-complexity Products	Weapons
8	Services and Utilities	Chemicals	Textile	Chemical Manufacturing	Weapons	Machinery and Construction	High-complexity Products
9	Textile	Textile	Chemical Manufacturing	Precious Stones	Clothing and Accessories	Clothing and Accessories	Clothing and Accessories
10	Chemical Manufacturing	Chemical Manufacturing	Precious Stones	Clothing and Accessories	Precious Stones	Precious Stones	Raw Manufacturing
11	Precious Stones	Precious Stones	Clothing and Accessories	Vegetables, Fruits and Plants	Raw Manufacturing	Raw Manufacturing	Precious Stones
12	Clothing and Accessories	Clothing and Accessories	Raw Manufacturing	Raw Manufacturing	Wood Products	Metals	Wood Products
13	Raw Manufacturing	Raw Manufacturing	Metals	Metals	Metals	Wood Products	Metals
14	Energy Drilling and Mining	Energy Drilling and Mining	Energy Drilling and Mining	Wood Products	Energy Drilling and Mining	Energy Drilling and Mining	Energy Drilling and Mining
15	Wood Products	Wood Products	Wood Products	Energy Drilling and Mining	Animals and By-products	Animals and By-products	Animals and By-products
16	Animals and By-products	Animals and By-products	Animals and By-products	Animals and By-products	Vegetables, Fruits and Plants	Food and Preparations	Food and Preparations
17	Food and Preparations	Food and Preparations	Food and Preparations	Food and Preparations	Food and Preparations	Vegetables, Fruits and Plants	Vegetables, Fruits and Plants
ECI	2.261503667	2.520234671	3.08896214	3.452901685	4.299466299	4.439916975	5.069638102

Table 9. Sample Incremental SDV Sensitivity for High-Complexity Products (2018)

Contingency Plan

The Contingency Plan aims to present a set of solutions with respect to upheavals in different industries. Instead of compensating for the declining production directly, the best strategy is to develop those incipiently profitable industries. In this manner, we can derive a contingency strategy for countries to deal with possible abrupt declines of crucial industries. In some cases, the SDV remains unchanged even when a zero-opportunity-gain industry declines to 20% in terms of export. We can then conclude the industry is not indispensable to the country. As a clarification, the three consecutive N/As mean that the country doesn't even need to respond to a collapse in the industry. Countries tend to have distinct solutions to the ups and downs of the same industry. To create the contingency strategy table, we decrease the

export level for each industry in the country's current production space by 60% respectively. The three highest-ranking industries in the new SDV are then returned.

Product Names	0	1	2
Animal and By-products	Services and Utilities	Daily Instruments	Weapons
Vegetables, Fruits and Plants	Services and Utilities	Daily Instruments	Weapons
Food and Preparations	Services and Utilities	Daily Instruments	Weapons
Energy Drilling and Mining	Services and Utilities	Daily Instruments	Weapons
Chemicals	Services and Utilities	Daily Instruments	Weapons
Chemical Manufacturing	Services and Utilities	Daily Instruments	Weapons
Raw Manufacturing	Services and Utilities	Daily Instruments	Weapons
Wood Products	Services and Utilities	Daily Instruments	Weapons
Clothing and Accessories	Services and Utilities	Daily Instruments	Weapons
Textile	Services and Utilities	Daily Instruments	Weapons
Metals	Services and Utilities	Daily Instruments	Weapons
Machinery and Constructions	Services and Utilities	Daily Instruments	Weapons
Transportation	Services and Utilities	Raw Manufacturing	Daily Instruments
Weapons	Services and Utilities	Daily Instruments	Transportation
Daily Instruments	Services and Utilities	Weapons	Transportation
Precious Stones	Services and Utilities	Daily Instruments	Weapons
Daily Instruments	Services and Utilities	Daily Instruments	Weapons
Services and Utilities	Daily Instruments	Weapons	Transportation

Table 10. Sample Contingency Strategy (2018)

4.3 Sensitivity Analysis Results and Interpretation

We examine India's ECI Decremental and Incremental Sensitivity Charts for 2022. An increase in Raw Manufacturing will lead to the highest change in ECI, followed by Chemicals. The strong sensitivity effect of manipulating the Raw Manufacturing category changes from previous years. For the negative shock cases, Weapons becomes most impactful, which is a new trend. The rest of the industries do not appear to have the same level of sensitivity.

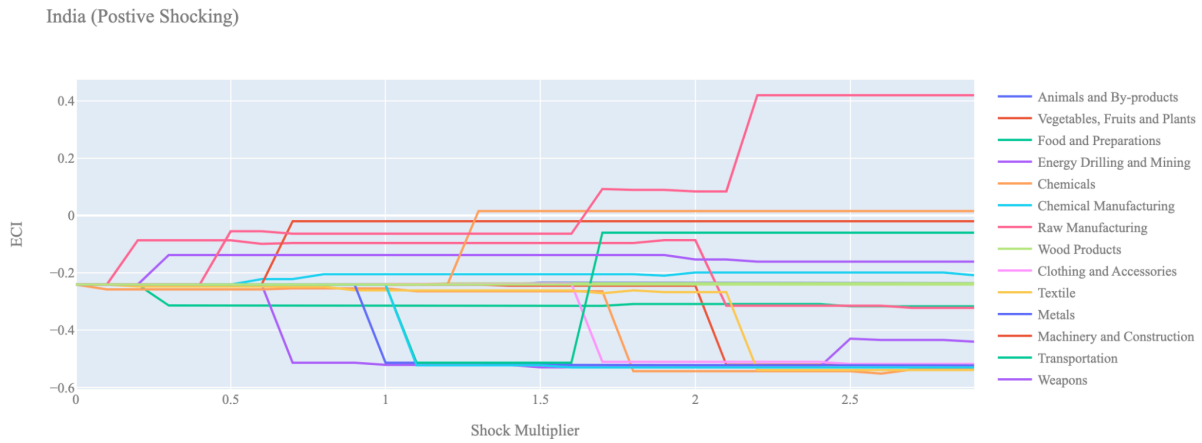


Figure 6a. Incremental ECI Sensitivity for India (2022)

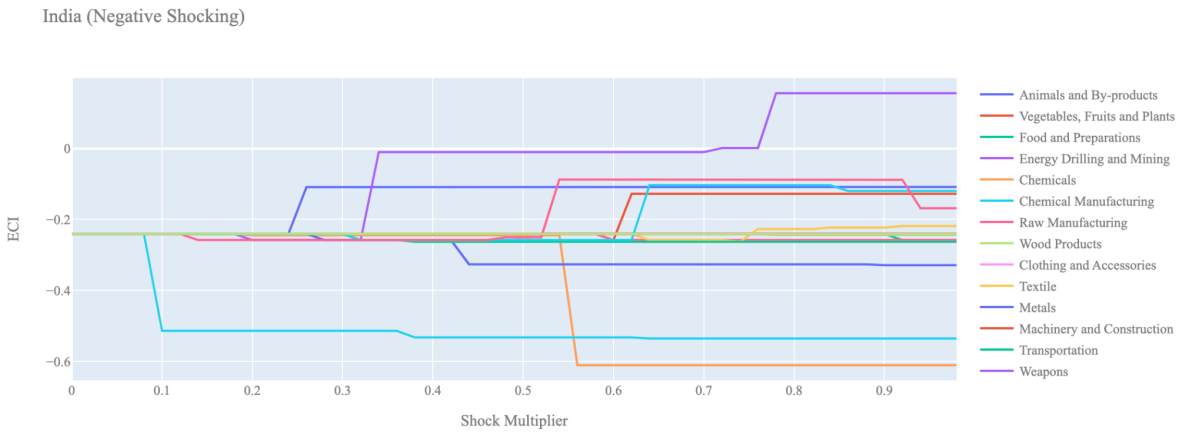


Figure 6b. Decremental ECI Sensitivity for India (2022)

Below are India's 2018 ECI Sensitivity Charts. In the positive chart, we immediately observe that increases in High Complexity Products, Transportation, and Machinery contribute to higher ECI levels. This combination of industries is typical for well-developed countries. High Complexity Products, in particular, offer the greatest ECI growth per unit of export increase. Other industries, however, have a minimal impact on ECI, making it clear which sectors India should prioritize to improve its economic complexity.

Turning to India's 2018 Negative Shock chart, we find that the country is most sensitive to declines in Chemical Manufacturing and Textiles. Interestingly, despite the negative ECI, reducing exports in certain industries that do not significantly contribute to the ECI score results in notable improvements in the overall ECI level. This highlights the potential for India to enhance its economic complexity by scaling back on less impactful sectors.

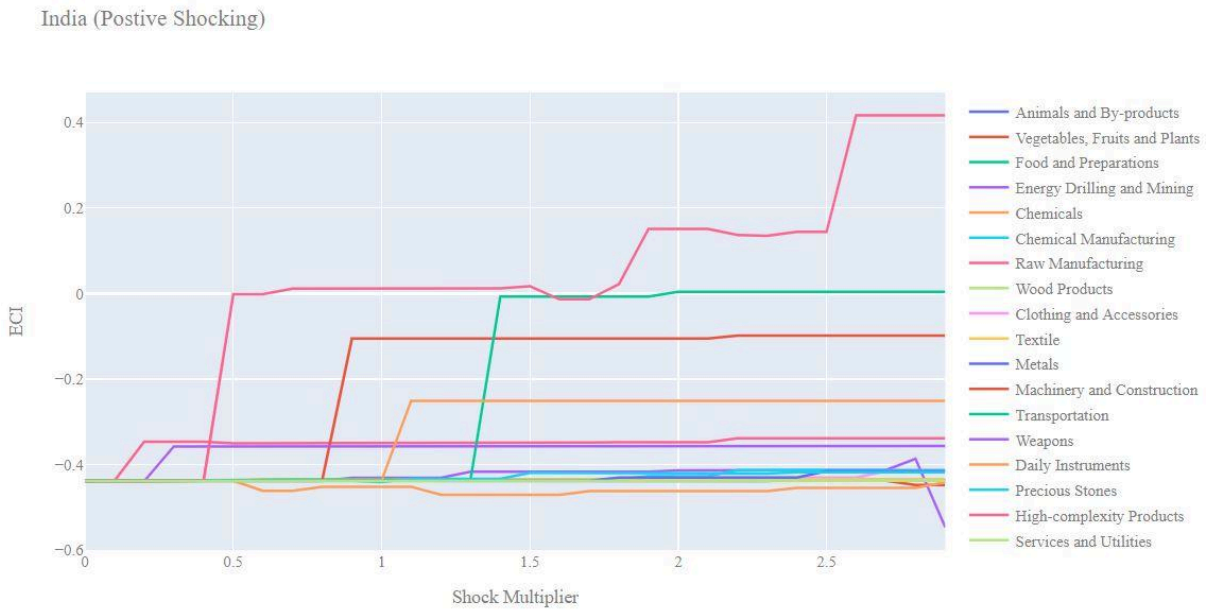


Figure 7a. Incremental ECI Sensitivity for India (2018)

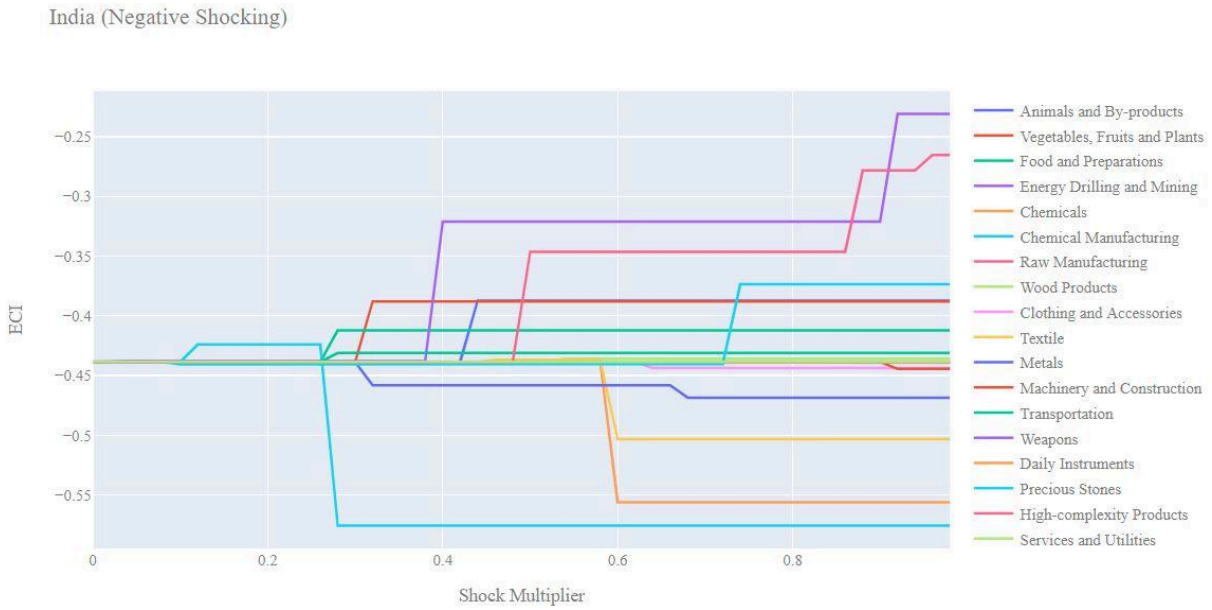


Figure 7b. Decremental ECI Sensitivity for India (2018)

Next, we examine the 2013 ECI Sensitivity graphs. In the positive shock scenario, we observe that the ECI sensitivity landscape has not changed significantly over the five-year period. High Complexity Products continue to offer the best prospects for ECI growth. Additionally, as in 2018, Transportation and Machinery also have a positive impact on ECI levels.

In the 2013 negative shock scenario, India shows sensitivity to reductions in Chemical Manufacturing and Textiles, similar to the pattern in 2018. However, in 2013, we also observe that India is somewhat sensitive to declines in the Metals sector, a factor not as pronounced in 2018.

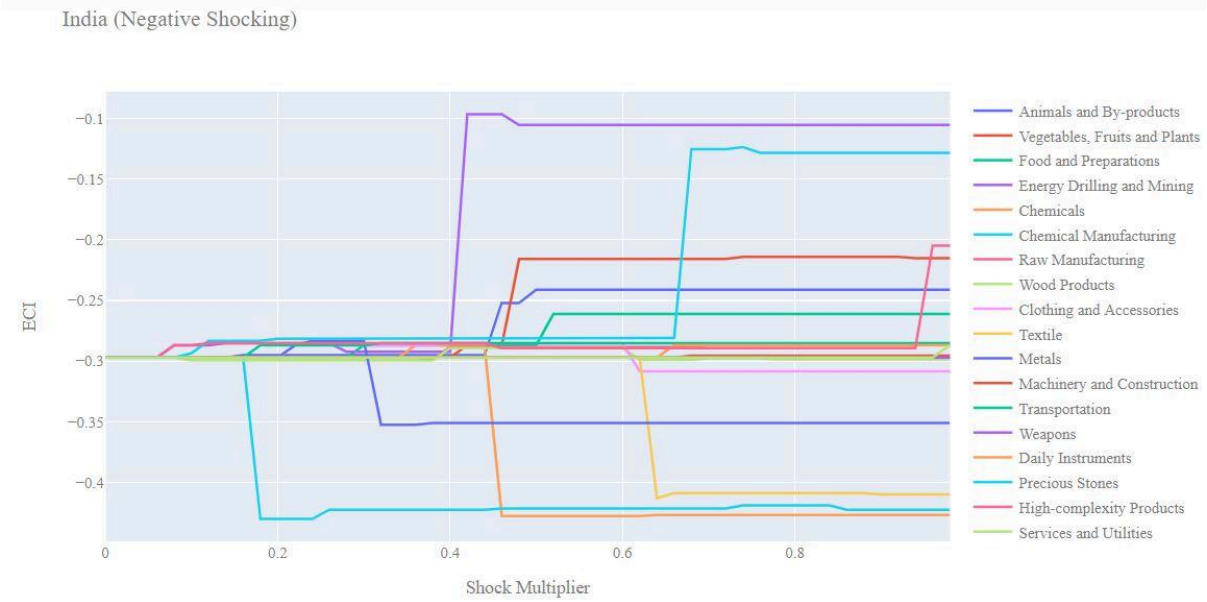


Figure 8a. Incremental ECI Sensitivity for India (2013)

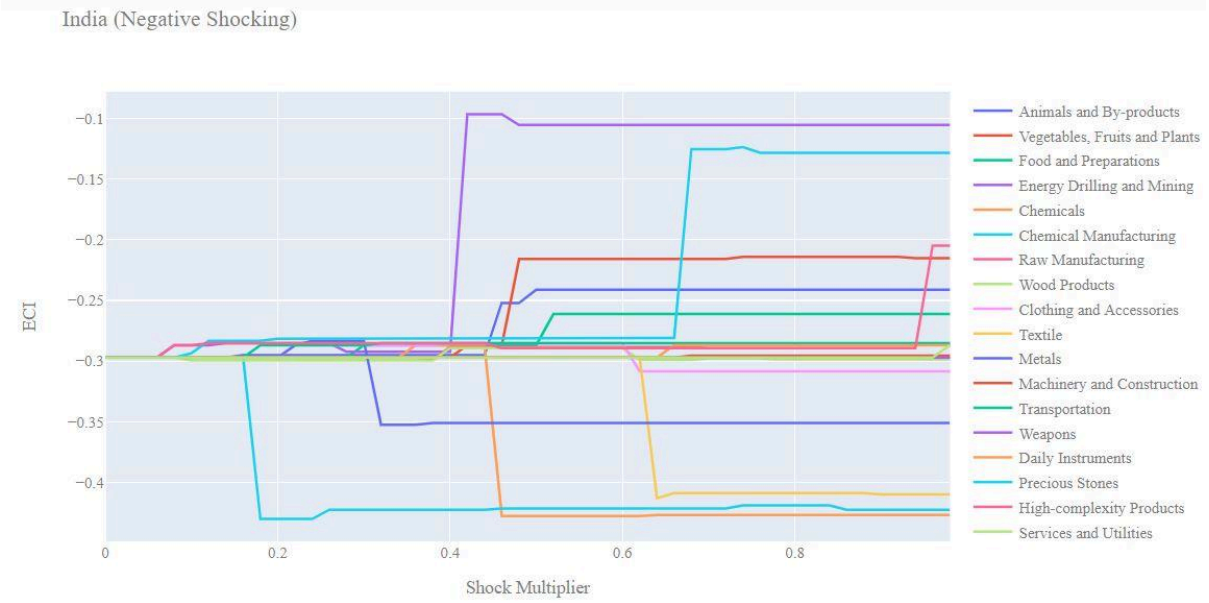


Figure 8b. Decremental ECI Sensitivity for India (2013)

Below we see the SDV sensitivity charts for High Complexity Products in 2018. India's SDV is somewhat sensitive to changes in High Complexity products since the Indian economy is dependent on the export of products from this industry. If High Complexity Products are shocked upwards far enough we see that many industries start having negative opportunity gains since at that point India's economy will become heavily dependent on High Complexity Products and the industries that are within close proximity.

Considering the Negative SDV sensitivity chart we observe that decreases in High Complexity Products only makes High Complexity Products an even more beneficial space to enter. This phenomenon is observed during the pandemic period, as India managed to increase its ECI despite the drawdown in High Complexity Products. We can see from the Food and Preparations SDV sensitivity chart that India is not especially dependent on this industry causing it's SDV to be fairly stable in the face of shocks to this industry.

	0.0%	50.0%	160.0%	180.0%	190.0%
0	High-complexity Products	Machinery and Construction	Machinery and Construction	Machinery and Construction	Vegetables, Fruits and Plants
1	Machinery and Construction	Services and Utilities	Daily Instruments	Daily Instruments	Machinery and Construction
2	Transportation	Transportation	Services and Utilities	Services and Utilities	Clothing and Accessories
3	Services and Utilities	Wood Products	Transportation	Raw Manufacturing	Textile
4	Daily Instruments	Vegetables, Fruits and Plants	Chemical Manufacturing	Transportation	Energy Drilling and Mining
5	Chemical Manufacturing	Food and Preparations	Weapons	Chemical Manufacturing	Chemicals
6	Vegetables, Fruits and Plants	Energy Drilling and Mining	Wood Products	Weapons	Wood Products
7	Food and Preparations	Chemicals	Vegetables, Fruits and Plants	Metals	High-complexity Products
8	Energy Drilling and Mining	Chemical Manufacturing	Energy Drilling and Mining	Food and Preparations	Animals and By-products
9	Chemicals	Clothing and Accessories	Chemicals	Vegetables, Fruits and Plants	Precious Stones
10	Clothing and Accessories	High-complexity Products	Clothing and Accessories	Energy Drilling and Mining	Transportation
11	Wood Products	Textile	High-complexity Products	Chemicals	Services and Utilities
12	Textile	Metals	Textile	Clothing and Accessories	Daily Instruments
13	Metals	Precious Stones	Metals	Wood Products	Weapons
14	Precious Stones	Animals and By-products	Precious Stones	High-complexity Products	Chemical Manufacturing
15	Animals and By-products	Daily Instruments	Animals and By-products	Textile	Raw Manufacturing
16	Weapons	Weapons	Raw Manufacturing	Precious Stones	Metals
17	Raw Manufacturing	Raw Manufacturing	Food and Preparations	Animals and By-products	Food and Preparations
ECI	-0.438570348	-0.001684255	-0.013635616	0.021737849	0.151192796

Table 11. India's Incremental SDV Sensitivities(2018)

	-0.0%	-50.0%	-88.0%
0	High-complexity Products	Machinery and Construction	High-complexity Products
1	Machinery and Construction	High-complexity Products	Transportation
2	Transportation	Transportation	Machinery and Construction
3	Services and Utilities	Services and Utilities	Services and Utilities
4	Daily Instruments	Raw Manufacturing	Raw Manufacturing
5	Chemical Manufacturing	Vegetables, Fruits and Plants	Vegetables, Fruits and Plants
6	Vegetables, Fruits and Plants	Food and Preparations	Food and Preparations
7	Food and Preparations	Energy Drilling and Mining	Energy Drilling and Mining
8	Energy Drilling and Mining	Chemicals	Chemicals
9	Chemicals	Chemical Manufacturing	Chemical Manufacturing
10	Clothing and Accessories	Clothing and Accessories	Clothing and Accessories
11	Wood Products	Wood Products	Wood Products
12	Textile	Textile	Textile
13	Metals	Metals	Metals
14	Precious Stones	Precious Stones	Weapons
15	Animals and By-products	Animals and By-products	Precious Stones
16	Weapons	Daily Instruments	Animals and By-products
17	Raw Manufacturing	Weapons	Daily Instruments
ECI	-0.438570348	-0.3463349	-0.278253191

Table 12. India's Decremental SDV Sensitivities (2018)

4.4 Contingency Strategy

Decreasing export of each industry in India's current production space by 60% respectively, we derive the contingency strategy shown below.

	0	1	2
Animals and By-products	Machinery and Construction	High-complexity Products	Transportation
Vegetables, Fruits and Plants	Vegetables, Fruits and Plants	High-complexity Products	Machinery and Construction
Food and Preparations	Machinery and Construction	High-complexity Products	Transportation
Energy Drilling and Mining	High-complexity Products	Machinery and Construction	Transportation
Chemicals	High-complexity Products	Machinery and Construction	Transportation
Chemical Manufacturing	High-complexity Products	Machinery and Construction	Transportation
Raw Manufacturing	Machinery and Construction	High-complexity Products	Transportation
Wood Products	Machinery and Construction	High-complexity Products	Transportation
Clothing and Accessories	Transportation	High-complexity Products	Machinery and Construction
Textile	High-complexity Products	Transportation	Machinery and Construction
Metals	High-complexity Products	Machinery and Construction	Transportation
Machinery and Construction	High-complexity Products	Machinery and Construction	Transportation
Transportation	High-complexity Products	Machinery and Construction	Transportation
Weapons	High-complexity Products	Machinery and Construction	Transportation
Daily Instruments	High-complexity Products	Machinery and Construction	Transportation
Precious Stones	High-complexity Products	Machinery and Construction	Transportation
High-complexity Products	High-complexity Products	Machinery and Construction	Transportation
Services and Utilities	High-complexity Products	Machinery and Construction	Transportation

Table 13. India's Contingency Strategy (2018)

5. Macro-level Predictions

5.1 Structural Optimality Index

ECI sensitivity described in the section before has proven to be a significant factor in deciding the economic outcomes of countries. In order to quantitatively evaluate how effective our development strategies are and how deviations from the suggested developmental path will lead to suboptimal growth results, we define the measure – Structural Optimality Index (SOI) – on a country level as the Adjusted R-Square obtained from regressing the country's realized industry development over the suggested development strategy. Both strategies are quantified in nature, with the realized development represented by increasing export in every major industry group and the suggested development strategy represented by the opportunity gains of developing the corresponding industry groups as calculated in previous sections. The adjusted R-square from the regression thus provides us with a quantified measure of how the development path adopted by the country has fitted with/differed from calculations on a complexity level.

After obtaining this measure for all countries in our database, we further regress countries' five-year economic growth, which is defined as the percent increase in GDP (USD), over their SOI. Figure 9 illustrates the regression output, which shows a strong positive correlation between countries' SOI and their five-year GDP growth, significant at the 1% level and achieving an adjusted R^2 of 4.5%. In other words, the more a country develops, as suggested by calculations on a complexity level, the better economic outcomes it achieves.

Table 14: OLS Regression Results	
Dep. Variable: GDP	**F-Statistic:** 5.963
R^2: 0.054	**Prob (F-Stat):** 0.0163
Adj R^2: 0.045	**No. Observations:** 106

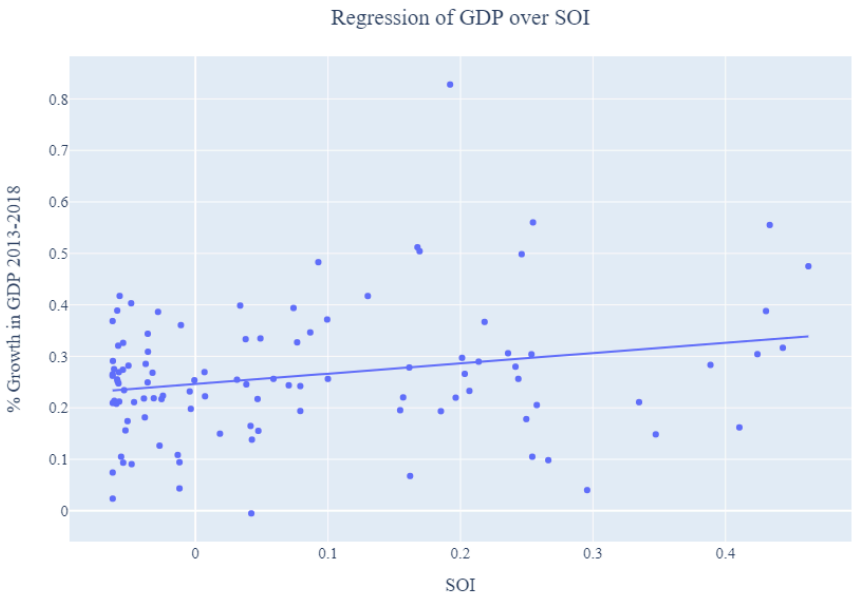


Figure 9. Regression of Five-Year GDP Growth over SOI (2013-2018)

5.2 SOI of India and Its Implications

During the first examined period, India, for instance, has a low level of structural optimality as compared with its developed peers. As the regression in Figure 10a suggests (the red curve represents export increase and the blue curve stands for opportunity gain of the corresponding industry), India demonstrates a moderate level of correlation with the suggested developmental path, having an adjusted R-square of around 0.126.

India ranks highly among all countries in terms of SOI and has made a fast rate of economic progress among its emerging peers from 2013 to 2018 with a 5 year GDP growth of 56.0%, which is consistent with the regression result in Figure 4b.This is in direct contrast to developed economies such as Japan, where there is moderate SOI of around -4.8% and a corresponding 5-year growth rate of 9.0%.

Specifically, India's economic progress from 2013 to 2018 can be at least partially explained by a development strategy that demonstrates a considerable but not perfect level of matches with our suggested developmental path. In fact, India invested heavily in the Transportation industry, while our model suggested focusing more on moderately complex industry groups such as Energy drilling/mining.

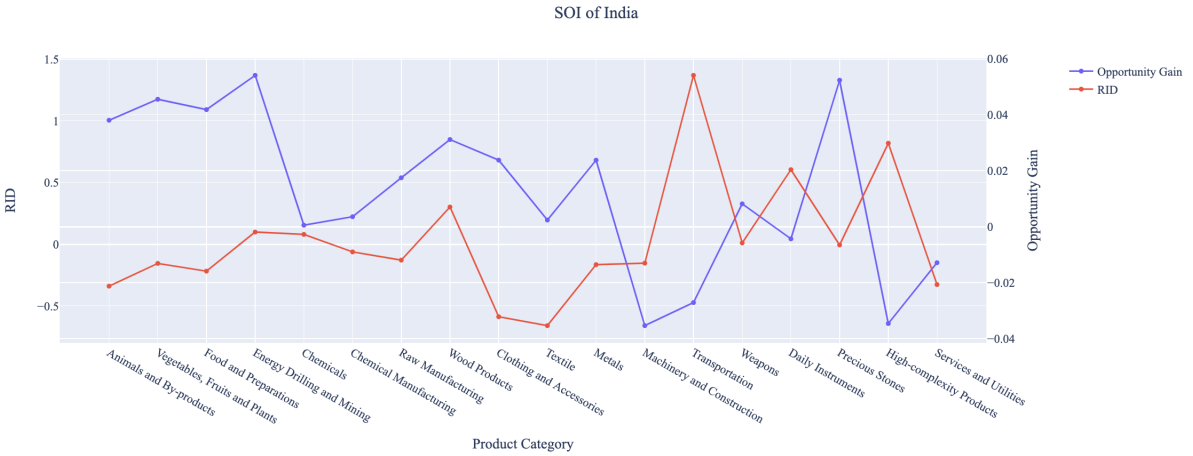


Figure 10a. SOI of India (2013-2018)

For the 2019-2022 years, India has continued to exhibit strong growth while progress is slow on a global scale during this period; India has adjusted well to negative economic shocks by decreasing SOI and period-over-period GDP growth.

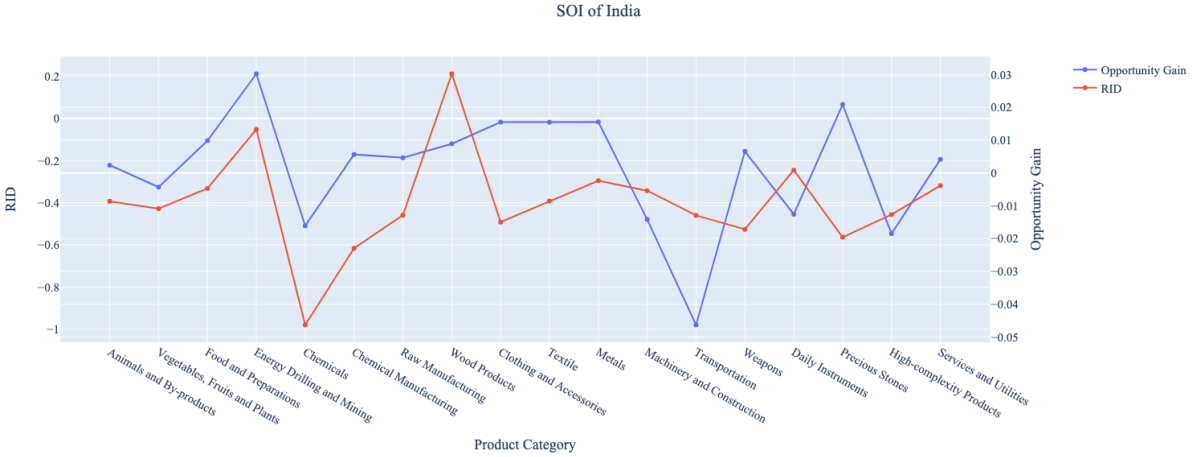


Figure 10b. SOI of India (2019-2022)

6. Concluding Remarks

In conclusion, India has demonstrated a high level of economic growth in terms of annual GDP increase during the period from 2013 to 2018, concurrent with an increase in economic complexity as compared with major developed economies. For 2019-2022, the growth in GDP has slowed alongside a large boost in ECI, higher than many comparable economies.

We believe that the mixed progress during the first period can be partially explained through the analysis of the economic and product complexity structure of India on the industry group level. The product classification system we adopt allows us to measure the realized industry development for various industry groups and to observe that India regressed in developing many of its industries across this period.

The mixed progress observed during this period can be partially explained by analyzing India's economic and product complexity structure at the industry group level. The product classification system we use enables us to assess the actual development of various industry groups and observe that India consistently focused on developing the Transportation, High-Complexity Products, and Daily Instruments sectors. In contrast, both developed countries and emerging economies globally pursued more complex and advanced industry paths. In 2022, this mixed progress was driven by India prioritizing the development of higher-complexity industries, despite global demand for basic, low-complexity products. As a result, while India's ECI improved, its GDP growth slowed compared to previous years and lagged behind some of its emerging economy counterparts.

Based on our analysis of opportunity gains and a sensitivity analysis of major industry groups, India could have furthered its progress by prioritizing High-Complexity Products, Transportation, and Machinery prior to the pandemic. However, given the economic disruptions caused by COVID-19, India now has an opportunity to enhance its gains by focusing on sectors such as Textiles and Chemicals. Additionally, we observe that India’s development strategy appears somewhat misaligned, as indicated by its relatively low level of structural optimality compared to other emerging economies. The adjusted R-square for structural optimality was around 12.6% from 2013-2018 and dropped to just 9.0% in 2022. Since a significant positive correlation exists between five-year GDP growth and the structural optimality index, India’s suboptimal growth experience—when compared to fast-growing economies both regionally and globally—becomes evident. This suggests that India has substantial potential to boost its economic performance through further optimization of its industrial structure, as proposed in this paper.

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